PREASSESSMENT EVALUATION OF INJURY TO NON-VEGETATED SHORELINES

Beaches

A beach is an accumulation of unconsolidated sediment that is transported and molded into characteristic forms by wave-generated water motion. Beaches will form virtually anywhere sediment is available and there is a site for sediment accumulation. Inherent to beaches is change, over time scales ranging from seconds to years. Knowing the patterns of change allows prediction of the behavior of oil spills and the persistence of oiled sediments.

Coastal sediments are classified according to the dominant size of the individual clasts into three general categories: mud (silt and clay), sand, and gravel (from granule to boulder). The variation between the different beach classifications is related to the grain size of the sediments composing the beach. Wentworth (1922) developed the following classification system:

Size Description	Size Range
clay	0.0002-0.004 mm
silt	0.004-0.0625 mm
fine-grained sand	0.0625-0.25 mm
coarse-grained sand	0.25 - 2 mm
granule	2 - 4 mm
pebble	4 - 64 mm
cobble	64 - 256 mm
boulder	> 256 mm

There is a general relationship between the sediment size and the slope of the beachface—the coarser the grain size, the steeper the beachface. The beach slope is also controlled by wave activity in that eroding beaches tend to flatten and accreting beach steepen. Knowledge of the sediment transport patterns for beaches (sand in particular) is important for understanding how oil behaves on them.

Summary of Known Impacts from Oil Spills

From the perspective of oil behavior on beaches, there are two basic factors:

1) The depth of oil penetration into the sediments, and

2) The potential for burial of oiled layers by clean sediments.

The behavior of oil on beach type (fine- and coarse-grained sand beaches, gravel beaches, and mixed sand and gravel beaches) is summarized below.

EXPOSED BEACHES, FINE-GRAINED SAND

- During small spills, oil will concentrate in a band along the high-tide line.
- Under heavy accumulations, oil can cover the entire intertidal area, although the oil w lifted off the lower part of the beach with the rising tide.
- Oil penetration into fine-grained sand will be less than 10 cm.
- Burial of oiled layers by clean sand within the first few weeks after the spill will be li usually to less than 30 cm along the upper beachface.
- Deeper burial is possible if the oil is deposited at the beginning of an accretionary period.
- Much of the oil will be removed during the next storm.
- Biological impacts include temporary declines in infaunal populations, which can also a feeding shorebirds.
- The usually hard, compact sediments will support pedestrian and vehicular traffic.

EXPOSED BEACHES, COARSE-GRAINED SAND

- During small spills, oil will concentrate in a band along the high-tide line.
- Under heavy accumulations, oil can cover the entire intertidal zone, although the oil w lifted off the lower part of the beach with the rising tide.
- Large amounts of oil can accumulate in the berm runnel where it is unable to drain o beach at low tide.
- Oil penetration into coarse-grained sand can reach 25 cm.
- Burial of oiled layers by clean sand within the first few weeks after the spill can be rapid.
- Burial over 1 m is possible if the oil is deposited at the beginning of an accretionary period
- Persistence of deeply buried oil could be long, depending upon the season of year and b cycle.
- Biological impacts include temporary declines in infaunal populations, which can also a feeding shorebirds.
- The sediment can be very soft, making vehicular access difficult.

SHELTERED BEACHES, BOTH FINE- AND COARSE-GRAINED SAND

- Oil penetration will be less where the sediments are finer and more poorly sorted.
- Depending on the degree of exposure to any waves, oil persistence can increase to mont years.
- Burial by clean sand is still significant but less than exposed beaches.
- Asphalt pavements can form under heavy accumulations; pavements will change the n and stability of the substrate and thus its biological utilization.

EXPOSED BEACHES, MIXED SAND AND GRAVEL

- During small spills, oil will be deposited along and above the high-tide swash.
- Large spills will spread across the entire intertidal area.
- Oil penetration into the beach sediments may be up to 50 cm.

- Burial of oil may be deep at and above the high-tide berm, where oil tends to persist.
- Oil can be stranded on low-tide terraces composed of gravel, particularly if the oil is weath or emulsified.

SHELTERED BEACHES, MIXED SAND AND GRAVEL

- Pavements are likely to form wherever heavy accumulations of oil can fill the voids bet the sediments.
- Once formed, these pavements are very stable and can persist for years.
- Any oil stranded above the high-tide line will be highly persistent.

Methods for Assessment of Impact to Shorelines

Preassessment surveys of oil impacts to shorelines should focus on documentation of the degree of oiling and impacts from cleanup on the shoreline. Often the response effort generates shoreline oiling data, as part of the SCAT (Shoreline Cleanup Assessment Team) process. If the shoreline oiling documentation is incomplete or too generalized for NRDA needs, then a more comprehensive assessment may be conducted by NRDA staff. Detailed methods for mapping the degree and extent on shorelines are provided by Owens and Sergy (1994), using standardized terminology and methods. Appendix 6 contains field forms, terminology and code sheets, and field estimation guides for use in shoreline surveys.

NRDA teams may need to make specific observations on the extent and degree of cleanup-related impacts to shoreline habitats. Cleanup-related impacts include:

- Physical removal of oiled sediments: Track volumes and locations of sediments removed from beaches and wetlands.
- Physical removal of oiled vegetation: Track areal extent of cut vegetation or vegetation removed during sediment removal in wetlands.
- Changes in sediment distribution patterns, from sediment reworking, moderate- to high-pressure flushing, or berm relocation: Track areal extent of changes in grain-size distribution.
- Physical disruption and trampling of soft substrates from both foot and vehicular traffic: Track areal extent and degree of disruption, and collect samples to document mixing of oil into substrate from trampling. Document vegetation impacts from disruption.